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Standard Method of Test for
VAPOR PRESSURE OF PETROLEUM PRODUCTS (REID METHOD)[1]

This Standard is issued under the fixed designation D 323; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval.

1. Scope

1.1 This method covers the determination of the absolute vapor pressure (Note 1) of volatile crude oil and volatile nonviscous petroleum products, except liquefied petroleum gases (Note 2).

NOTE 1—Because the external atmospheric pressure is counteracted by the atmospheric pressure initially present in the air chamber, the "Reid vapor pressure" is approximately the vapor pressure of the material at 100 F in pounds per square inch absolute.

NOTE 2—For determination of the vapor pressure liquefied petroleum gases reference should be made to ASTM Method D 1267, Test for Vapor Pressure of Liquefied Petroleum (LP) Gases (LP-Gas Method).[2]

NOTE 3—The values stated in U.S. customary units are to be regarded as the standard. The metric equivalents of U.S. customary units may be approximate.

2. Summary of Method

2.1 The gasoline chamber of the vapor pressure apparatus is filled with the chilled sample and connected to the air chamber at 100 F or other temperature. The apparatus is immersed in a constant-temperature bath (100 ± 0.2 F) and is shaken periodically until equilibrium is reached. The "manometer reading" corresponding to the pressure, read on the gage attached to the apparatus, suitably corrected (Table 1) if the air chamber was initially at a temperature other than 100 F, is the *Reid vapor pressure.*

2.2 This method provides for partial air saturation of products with Reid vapor pressure below 26 lb (Sections 1 to 8, and 16), for no air saturation for products about 26 lb (Sections 9 to 14, and 16) and for narrower tolerances in certain features for the measurement of the vapor pressure of aviation gasolines (Sections 15 and 16).

3. Apparatus

3.1 The construction of the required apparatus is described in the Appendix. For samples having vapor pressures below 26 lb, use the gasoline chamber with one opening (A1.1.2) and for samples having vapor pressures above 26 lb, use the gasoline chamber with two openings (A1.1.3).

4. Handling of Samples

4.1 The general provisions in 4.2 to 4.6 shall apply to all samples for vapor pressure determinations, except as specifically excluded for samples having vapor pressures above 26 lb (see Section 11). The extreme sensitivity of vapor pressure measurements to losses through evaporation and to slight changes in composition is such as to require the utmost precaution and the most meticulous care in the handling of samples.

4.2 Sampling shall be done in accordance with the procedure for Reid vapor pressure as described in ASTM Method D 270, Sampling Petroleum and Petroleum Products.[2]

4.3 *Sample Container Size*—The size of the sample container from which the vapor pressure sample is taken shall be not less than 1 qt nor more than 2 gal.

4.4 *Sample Handling Temperature*—In all cases the sample container and its contents shall be cooled to 32 to 40 F before the container is opened.

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[1] This method is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants. A list of members may be found in the ASTM Yearbook.

Current edition effective Sept. 22, 1958. Originally issued 1930. In 1937, revised and consolidated with D 417. Replaces D 323 – 56.

[2] *Annual Book of ASTM Standards*, Part 18.

4.5 *Sample Transfer*—The Reid vapor pressure determination shall be the first test run on a sample. In the instances of transfer of liquids from larger sample containers or of withdrawal of samples for other tests, the transfer connection of Fig. 1 shall be used.

4.6 *Care of Samples*—Samples shall be put in a cool place as soon as possible after they have been obtained and held there until the test has been completed. Samples in leaky containers shall not be considered for tests but shall be discarded and new samples obtained.

5. Preparation for Test

5.1 *Air Saturation of Sample in Sample Container*—With the sample at a temperature of 32 to 40 F, take the container from the water cooling bath, unseal it, and examine it for its liquid content which shall be between 70 and 80 percent of the container capacity. After the correct liquid content has been assured, reseal the container, shake it vigorously, and return it to the water cooling bath.

5.2 *Preparation of Gasoline Chamber*—Completely immerse the open gasoline chamber and the sample transfer connection in the water cooling bath for a sufficient time to allow the chamber and connection to reach the bath temperature (32 to 40 F).

5.3 *Preparation of Air Chamber* (*100 F Procedure*)—After purging and rinsing the air chamber and pressure gage in accordance with 6.5, connect the gage to the air chamber. Immerse the air chamber to at least 1 in. above its top in the water bath maintained at 100 ± 0.2 F (see Note 5), for not less than 10 min just before coupling it to the gasoline chamber. Do not remove the air chamber from the bath until the gasoline chamber has been filled with sample as described in 6.1.

5.4 *Preparation of Air Chamber* (*Ambient Temperature Procedure*)—As an alternative to 5.3, adjust the air chamber to ambient or other temperature which may be determined with an accuracy of at least 1 F in the following manner: After purging and rinsing the air chamber and pressure gage in accordance with 6.1, connect the gage to the air chamber. Insert the thermometer into the air chamber, supporting it by means of a loosely fitting (not airtight) stopper in the opening of the air chamber. Adjust the position of the thermometer so that it is aligned as closely as possible with the axis of the air chamber, and with the thermometer bulb located in the air chamber, about 9 in. from the opening. Leave the thermometer in position until the temperature reading has remained constant within 1 F for a period of 5 min or more just before coupling the air chamber to the gasoline chamber. At this time, record the thermometer reading as the "initial air temperature."

6. Procedure

6.1 *Sample Transfer*—With everything in readiness, remove the chilled sample container from the bath, uncap it, and insert the chilled transfer connection and air tube (see Fig. 1). Quickly empty the chilled gasoline chamber and place it over the sample delivery tube of the transfer connection. Invert the entire system rapidly so that the gasoline chamber is finally in an upright position with the delivery tube extending to within $^1/_4$ in. of the bottom of the gasoline chamber. Fill the gasoline chamber to overflowing. Lightly tap the gasoline chamber against the work bench to ensure that the sample is free of air bubbles. If any sample is displaced, refill the chamber to overflowing.

6.2 *Assembly of Apparatus*—Without delay, and as quickly as possible, attach the air chamber to the gasoline chamber. Not more than 20 s shall be consumed in completing the assembly of the apparatus after filling the gasoline chamber, using the following sequence of operations.

6.2.1 Add additional sample to the gasoline chamber to fill to overflowing,

6.2.2 Read the initial air temperature of the air chamber (5.4) or remove the air chamber from the 100 F water bath (5.3).

6.2.3 Connect the air chamber to the gasoline chamber.

6.3 *Introduction of Apparatus into Bath*—Turn the assembled vapor pressure apparatus upside down to allow the sample in the gasoline chamber to run into the air chamber and shake vigorously in a direction parallel to the length of the apparatus. Immerse the assembled apparatus in the bath, maintained at 100 ± 0.2 F, in an inclined position so that the connection of the gasoline and air chambers is below the water level and may be observed closely for leaks. If no leaks are observed, immerse the apparatus to at least 1 in. above the top of the air chamber. Observe the apparatus for leaks throughout the test. When at any time a leak is detected, discard the test.

NOTE 4—Liquid leaks are more difficult to detect than vapor leaks; and because the much-used coupling device is normally in the liquid section of the apparatus, give it particular attention.

6.4 *Measurement of Vapor Pressure*—After the assembled vapor pressure apparatus has been immersed in the bath for 5 min, tap the pressure gage lightly, and observe the reading. Withdraw the apparatus from the bath, invert it, shake it vigorously, and replace it in the bath in the shortest possible time to avoid cooling the apparatus. At intervals of not less than 2 min, repeat this agitation and gage observation at least five times, until the last two consecutive gage readings are constant, to ensure equilibrium. These operations normally require 20 to 30 min. Read the final gage pressure to the nearest 0.05 lb for gages with intermediate graduations of 0.1 psi and to the nearest 0.1 lb for gages with graduations of 0.2 to 0.5 psi, and record this value as the "uncorrected vapor pressure" of the sample under test. Immediately remove the pressure gage and check its reading against that of the manometer, recording the value found as the Reid vapor pressure (under the procedure of 5.3), or as the "manometer reading" to be used in the calculations of Section 8 (under the procedure of 5.4).

6.5 *Preparation of Apparatus for Next Test*—Disconnect the air chamber, gasoline chamber, and pressure gage (Note 5). Remove trapped fluid in the Bourdon tube by repeated centrifugal thrusts. This may be accomplished in the following manner: hold the gage between the palms of the hands with the right hand on the face side and the threaded connection of the gage forward. Extend the arms forward and upward at an angle of 45 deg with the coupling of the gage pointing in the same direction. Swing the arms downward through an arc of about 135 deg so that the centrifugal force aids gravity in removing the trapped liquid. Repeat this operation three times to expel all liquid. Purge the pressure gage by directing a small jet of air into its Bourdon tube for at least 5 min. Thoroughly purge the air chamber of residual sample by filling the air chamber with warm water (above 90 F) and allowing it to drain (Note 6). Repeat this purging at least five times. After thoroughly removing the previous sample from the gasoline chamber, immerse the chamber in the ice bath for the next test.

NOTE 5—In the case of crude oil, the Bourdon tube must be washed with a volatile solvent after each test.

NOTE 6—If the purging of the air chamber is done in a bath, be sure to avoid small and unnoticeable films of floating sample by keeping the bottom and top openings of the chambers closed as they pass through the surface of water.

7. Precautions

7.1 Gross errors can be obtained in vapor pressure measurements if the prescribed procedure is not followed carefully. The following list emphasized the importance of strict adherence to the precautions given in the procedure:

7.1.1 *Checking the Pressure Gage*—Check all gages against a manometer after each test in order to ensure higher precision of results (6.4). Read all gages while the gage is in a vertical position.

7.1.2 *Air Saturation of Sample*—Open and close the sample container once after the contents have reached a temperature of 32 to 40 F. Shake the container vigorously to ensure equilibrium of the sample with the air in the container (5.1).

7.1.3 *Checking for Leaks*—Check all apparatus before and during each test for liquid and vapor leaks (A1.1.6 and Note 4).

7.1.4 *Sampling*—Because initial sampling and the handling of samples will greatly affect the final results, employ the utmost precaution and the most meticulous care to avoid losses through evaporation and slight changes in composition (Sections 4 and 6.1). In no case shall any part of the Reid apparatus itself be used as the sample container previous to actually conducting the test.

7.1.5 *Purging the Apparatus*—Thoroughly purge the pressure gage, the gasoline chamber, and the air chamber to be sure that they are free of residual sample. (This is most conveniently done at the end of the previous test.) (See 6.5.)

7.1.6 *Coupling the Apparatus*—Carefully observe the requirements of 6.2.

7.1.7 *Shaking the Apparatus*—Shake the apparatus "vigorously" as directed in 6.4 in order to ensure equilibrium.

7.1.8 *Temperature Control*—Carefully control the temperature at the time of air saturation and the temperature of the 100 F bath (Appendix, A1.3 and A1.4, respectively). Be certain that the temperature of the air in the air chamber at the time of coupling with the gasoline chamber (6.2) has remained constant within 1 F for a period of 5 min or more.

8. Calculation

8.1 *Change in Pressure of Water Vapor and Air*—For the ambient temperature procedure described in 5.4, calculate the "Reid vapor pressure" of the sample under test by applying to the "manometer reading" the correction given in Table I for the change in pressure of the water vapor and air in the chamber on heating from the "initial air temperature" to 100 F.

8.2 *Recording Results*—If the 100 F Procedure was employed (5.3), record the result observed in 6.4 as the "Reid vapor pressure" in pounds without reference to temperature or to unit of surface. If the ambient temperature procedure (5.3 and 8.1) was used, record the value resulting from the application of the correction from 8.1 as the "Reid vapor pressure" without reference to temperature or unit of surface.

MODIFICATIONS FOR PRODUCTS HAVING REID VAPOR PRESSURES ABOVE 26 LB

9. General

9.1 With products having vapor pressures over 26 lb (Note 7), the procedure described in Sections 4 to 7 is hazardous and inaccurate. Consequently, the following sections define changes in apparatus and procedure for the determination of vapor pressures above 26 lb. Except as specifically stated, all the requirements of Sections 1 to 8 and Section 16 shall apply.

NOTE 7—When the question arises, the air saturation method shall be used to determine whether or not a product has a vapor pressure above 26 lb.

10. Apparatus

10.1 *Bomb*, as described in the Appendix using the gasoline chamber with two openings.

10.2 *Pressure Gage Calibration*—A dead-weight tested (A1.7) may be used in place of the mercury manometer (A1.6) for checking gage readings above 26 lb. In 6.4, 7.1, and 8.1, and Table 1 where the words "manometer" and "manometer reading" appear, include as an alternate "dead-weight tester" and "calibrated gage reading," respectively.

11. Handling of Samples

11.1 4.3, 4.4, and 4.5 shall not apply.

11.2 *Sample Container Size*—The size of the sample container from which the vapor pressure sample is taken shall not be less than 1 pt liquid capacity.

12. Preparation for Test

12.1 5.1 and 5.2 shall not apply.

12.2 Any safe method of displacement of the test sample from the sample container that assures filling the gasoline chamber with a chilled, unweathered sample may be employed. The following 12.3 to 12.5, together with Section 13, describe displacement by self-induced pressure.

12.3 Maintain the sample container at a temperature sufficiently high to maintain superatmospheric pressure but not substantially over 100 F.

12.4 Completely immerse the gasoline chamber, with both valves open, in the water cooling bath for a sufficient length of time to allow it to reach the bath temperature (32 to 40 F).

12.5 Connect a suitable ice-cooled coil to the outlet valve of the sample container.

NOTE 8—A suitable ice-cooled coil can be prepared by immersing a spiral of approximately 25 ft of $^{1}/_{4}$-in. copper tubing in a bucket of ice water.

13. Procedure

13.1 6.1 and 6.2 shall not apply.

13.2 Connect the $^{1}/_{4}$-in. valve of the chilled gasoline chamber to the ice-cooled coil. With the $^{1}/_{2}$-in. valve of the gasoline chamber closed, open the outlet valve of the sample container and the $^{1}/_{4}$-in. valve of the gasoline chamber. Open the gasoline chamber $^{1}/_{2}$-in. valve slightly and allow the gasoline chamber to fill slowly. Allow the sample to overflow until the overflow volume is 200 ml or more. Control this operation so that no appreciable drop in pressure occurs at the gasoline chamber $^1/_4$-in. valve. In the order named, close the gasoline chamber $^1/_2$-in. and $^1/_4$-in. valves; and then close all other valves in the sample system. Disconnect the gasoline chamber and the cooling coil. (**Caution:** Safe means for disposal of liquid and vapor escaping during this whole operation must be provided. To avoid rupture because of the liquid-full condition of the gasoline chamber, the gasoline chamber must be quickly attached to the air chamber and the $^1/_2$-in. valve opened.)

13.3 Immediately attach the gasoline chamber to the air chamber and open the gasoline chamber $^1/_2$-in. valve. Not more than 25 s shall be consumed in completing the assembly of the apparatus after filling the gasoline chamber, using the following sequence of operations: (*1*) read the initial air temperature or remove the air chamber from the water bath, (*2*) connect the air chamber to the gasoline chamber, and (*3*) open the gasoline chamber $^1/_2$-in. valve.

13.4 If a dead-weight tester is used instead of the mercury manometer (10.2), apply the calibration factor in pounds per square inch established for the pressure gage at or near the "uncorrected vapor pressure" to the "uncorrected vapor pressure," recording the value found as the "calibrated gage reading" to be used in the calculations of Section 8 and Table 1 in place of the "manometer reading."

14. Precautions

14.1 The precaution 7.2 shall not apply.

MODIFICATIONS FOR AVIATION GASOLINE OF ABOUT 7 LB VAPOR PRESSURE

15. General

15.1 The following paragraphs define changes in apparatus and procedure for the determination of the vapor pressure of aviation gasoline. Except as specifically stated herein, all the requirements set forth in Sections 1 to 8, and 16 shall apply.

15.1.1 *Ratio of Air and Gasoline Chambers*—The ratio of the volume of the air chamber to the volume of the gasoline chamber shall be between the limits of 3.95 and 4.05 (see Note A1 in the Appendix).

15.1.2 *Water Cooling Bath*—The water cooling bath shall be held at a temperature of 32 to 34 F (See 3.3).

15.1.3 *Checking the Pressure Gage*—The gage shall be checked at 7 lb against a mercury column before each vapor pressure measurement to ensure that it conforms to the requirements of Section A2. This preliminary check shall be made in addition to the final gage comparison specified in 6.4.

15.1.4 *Air Chamber Temperature*—The provisions of 5.3 shall be followed; the provisions of 5.4 shall not apply.

16. Precision

16.1 The following criteria should be used for judging the acceptability of results (95 percent confidence):

16.1.1 *Repeatability*—Duplicate results by the same operators should be considered suspect if they differ by more than the following amounts:

Range	Repeatability (Same Operator and Apparatus)
0 to 5 lb	0.1
5 to 16 lb (except aviation gasoline)	0.2
16 to 26 lb	0.3
Above 26 lb	0.4
Aviation gasoline (approximately 7 lb)	0.1

16.1.2 *Reproducibility*—The results submitted by each of two laboratories should be considered suspect if they differ by more than the following amounts:

Range	Reproducibility (Different Operator and Apparatus)
0 to 5 lb	0.35
5 to 16 lb (except aviation gasoline)	0.3
16 to 26 lb	0.4
Above 26 lb	0.7
Aviation gasoline (approximately 7 lb)	0.15

TABLE 1 Corrections to be Subtracted from "Manometer Readings" for Calculating Reid Vapor Pressure

Initial Air Temperature,[a] deg F	Barometric Pressure,[a] mm Hg		
	760	700	600
32	2.90	2.70	2.45
40	2.60	2.45	2.20
50	2.20	2.10	1.90
60	1.80	1.70	1.55
70	1.40	1.30	1.20
80	0.95	0.90	0.85
90	0.50	0.50	0.45
100	0.00	0.00	0.00
110	−0.55	−0.55	−0.50

[a] For other temperatures and pressures, the corrections may be calculated by means of the following equation:

Correction =

$$[(P - P_t)(t - 100)/460 + t] - (P_{100} - P_t)$$

where:

t = air chamber temperature at beginning of test, deg F.

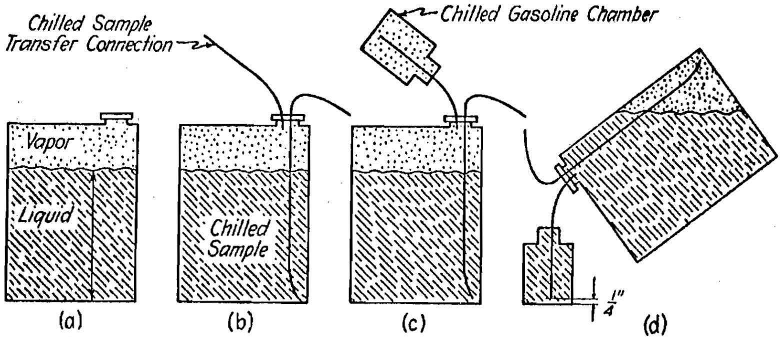
P = barometric pressure, psi, at time of test (if a barometer is not available, the normal barometric pressure may be used),

P_t = vapor pressure of water, psia, at t deg F, and

P_{100} = vapor pressure of water, psia, at 100 F = 0.95.

Calculated corrections are to be rounded off to the nearest 0.05 psi.

Example—The pressure gage gives an "uncorrected vapor pressure" reading of 11.6 psi. When the gage is compared to a mercury column, a "manometer reading" of 11.5 psi is obtained. For an "initial air temperature" of 80 F and atmospheric pressure of 700 mm Hg, the correction shown in Table 1 is 0.90 psi. Because the "initial air temperature" is below 100 F, this correction of 0.90 psi is subtracted from the "manometer reading" of 11.5 psi giving, a "Reid vapor pressure" of 10.60 psi.



(a) Sample Container Prior to Transfer of Sample

(b) Sealing Closure Replaced by Sample Transfer Connection

(c) Gasoline Chamber Placed Over Liquid Delivery Tube

(d) Position of System for Sample Transfer

FIG. 1 Simplified Sketches Outlining Method of Transferring Sample to Gasoline Chamber from Open-Type Containers ($^1/_4$ in. = 6.25 mm).

APPENDIX

A1. APPARATUS FOR REID VAPOR PRESSURE TEST

A1.1 *Reid Vapor Pressure Bomb*, consisting of two chambers—an air chamber (upper section) and a gasoline chamber (lower section)—shall conform to the following requirements:

NOTE A1: **Caution**—*To maintain the correct volume ratio between the air chamber and the gasoline chamber, the units shall not be interchanged without recalibrating to ascertain that the volume ratio is within satisfactory limits.*

A1.1.1 *Air Chamber*—The upper section or air chamber, as shown in Fig. A1. shall be a cylindrical vessel $2 \pm {}^{1}/_{8}$ in. in diameter and $10 \pm {}^{1}/_{8}$ in. in length, inside dimensions, with the inner surfaces of the ends slightly sloped to provide complete drainage from either end when held in a vertical position. On one end of the air chamber, a suitable gage coupling with an internal diameter not less than ${}^{3}/_{16}$ in. shall be provided to receive the ${}^{1}/_{4}$-in. gage connection. In the other end of the air chamber an opening approximately ${}^{1}/_{2}$ in. in diameter shall be provided for coupling with the gasoline chamber. Care shall be taken that the connections to the end openings do not prevent the chamber from draining completely.

A1.1.2 *Gasoline Chamber* (*One-Opening*)—The lower section or gasoline chamber, as shown in Fig. A1, shall be a cylindrical vessel of the same inside diameter as the air chamber and of such volume that the ratio of the volume of the air chamber to the volume of the gasoline chamber shall be between the limits of 3.8 and 4.2 (see Note A2). In one end of the gasoline chamber an opening approximately ${}^{1}/_{2}$ in. in diameter shall be provided for coupling with the air chamber. The inner surface of the end containing the coupling member shall be sloped to provide complete drainage when inverted. The other end of the gasoline chamber shall be completely closed.

NOTE A2—The ratio for units to be used for aviation gasoline testing shall be 3.95 to 4.05.

A1.1.3 *Gasoline Chamber* (*Two-Opening*)—For sampling from closed vessels, the lower section or gasoline chamber, as shown in Fig. A1 shall be essentially the same as the gasoline chamber described in A1.1.2, except that a ${}^{1}/_{4}$-in. valve shall be attached near the bottom of the gasoline chamber and a ${}^{1}/_{2}$-in. straight-through, full-opening valve shall be introduced in the coupling between the chambers. The volume of the gasoline chamber, including only the capacity enclosed by the valves, shall fulfill the volume ratio requirements as set forth in A1.1.2.

NOTE A3—In determining capacities for the two-opening gasoline chamber (Fig. A1), the capacity of the gasoline chamber shall be considered as that below the ${}^{1}/_{2}$-in. valve closure. The volume above the ${}^{1}/_{2}$-in. valve closure including the portion of the coupling permanently attached to the gasoline chamber shall be considered as a part of the air chamber capacity.

A1.1.4 *Method of Coupling Air and Gasoline Chambers*—Any method of coupling the air and gasoline chambers may be employed, provided that no gasoline is lost during the coupling operation, that no compression effect is caused by the act of coupling, and that the assembly is free from leaks under the conditions of the tests. To avoid displacement of gasoline during assembly, it is desirable that the male fitting of a suitable coupling be on the gasoline chamber. To avoid compression of air during the assembly of a suitable screw coupling, a vent hole may be used to ensure atmospheric pressure in the air chamber at the instant of sealing.

A1.1.5 *Volumetric Capacity of Air and Gasoline Chambers*—In order to ascertain if the volume ratio of the chambers is between the specified limits of 3.8 to 4.2 (see Note A2), measure a quantity of water greater than will be needed to fill the gasoline and air chambers. The gasoline chamber shall be completely filled with water, and the difference between the original volume and the remaining volume is the volume of the gasoline chamber. Then, after connecting the gasoline and air chambers, the air chamber shall be filled to the seat of the gage connection with more of the measured water, and the difference in volumes shall be the volume of the air chamber.

A1.1.6 *Checking for Freedom from Leaks*—Before placing new apparatus in service and as often as necessary thereafter, the assembled vapor pressure apparatus shall be checked for freedom from leaks by filling with air to 100-psi gage pressure and completely immersing in a water bath. Only apparatus which stands this test without leaking shall be used.

A1.2 *Pressure Gage*—The pressure gage shall be a Bourdon-type spring gage of test gage quality $4\,{}^{1}/_{2}$ to $5\,{}^{1}/_{2}$ in. in diameter provided with a nominal ${}^{1}/_{4}$-in. male thread connection with a passageway not less than ${}^{3}/_{16}$ in. in diameter from the Bourdon tube to the atmosphere. The range and graduations of the pressure gage used shall be governed by the

Gage to be Used

Reid Vapor Pressure, lb	Scale Range, psi	Maximum Numbered Intervals, psi	Maximum Intermediate Graduations, psi
4 and under	0 to 5	1	0.1
3 to 12	0 to 15	3	0.1
10 to 26	0 to 30	5	0.2
10 to 36	0 to 45	5	0.2
30 to 55	0 to 60	10	0.25
50 and higher	0 to 100	10	0.5

vapor pressure of the sample being tested, as follows:

Only accurate gages shall be continued in use. When the gage reading differs from the manometer (or dead-weight tester when testing gages above 26 lb) reading by more than 1 percent of the scale range of the gage, the gage shall be considered inaccurate. For example, the calibration correction shall not be greater than 0.15 psi for a 0 to 15-psi gage or 0.3 psi for a 0 to 30-psi gage.

NOTE A4—Gages 3 1/2 in. in diameter may be used in the 0 to 5 lb range.[3]

A1.3 *Water Cooling Bath*—A water cooling bath shall be provided of such dimensions that the sample containers and gasoline chambers may be completely immersed. Means for maintaining the bath at a temperature of 32 to 40 F shall be provided.

NOTE A5—Solid carbon dioxide shall not be used to cool samples in storage or in the preparation of the air saturation step. Carbon dioxide is appreciably soluble in gasoline, and its use has been found to be the cause of erroneous vapor pressure data.

A1.4 *Water Bath*—The water bath shall be of such dimensions that the vapor pressure apparatus may be immersed to at least 1 in. above the top of the air chamber. Means for maintaining the bath at a constant temperature of 100 ± 0.2 F shall be provided. In order to check this temperature, the bath thermometer shall be immersed to the 98 F mark throughout the vapor pressure determination.

A1.5 *Thermometers:*

A1.5.1 *For 100 F Air Chamber Procedure*—An ASTM Reid Vapor Pressure Thermometer No. 18F having a range from 94 to 108 F and conforming to the requirements in ASTM Specification E 1.[4]

A1.5.2 *For Water Bath*—Use the ASTM Thermometer 18F described in A1.5.1.

A1.5.3 *For Air Chamber*—When the ambient temperature procedure is employed, a thermometer conforming to the following requirements shall be used: Length, approximately 12 in.; range, −40 or −30 F to +120 or +130 F; graduated in 1 F divisions; total immersion; scale error not greater than 1 F.

A1.6 *Mercury Manometer*—A mercury manometer, having a range suitable for checking the pressure gage employed shall be used. The manometer scale may be graduated in steps of 1 mm, 0.1 in., or 0.1 psi.

A1.7 *Dead-Weight Tester*—A dead-weight tester may be used in place of the mercury manometer (A1.6) for checking gage readings above 26 lb.

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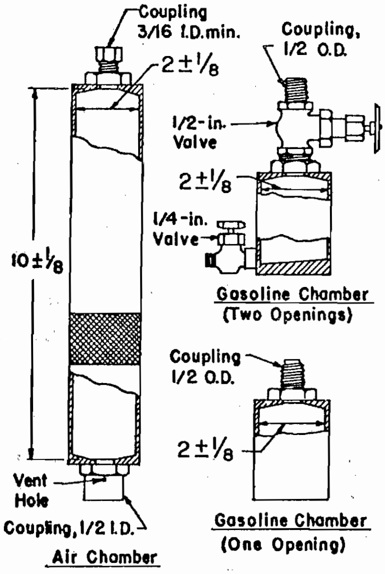
[3] Suitable gages are available from the Fisher Scientific Co. (Special Order), Pittsburgh, Pa. and U. S. Gauge Co. (Catalog No. 510SP), Sellersville, Pa.

[4] *Annual Book of ASTM Standards*, Parts 18 and 30.



Note: All Dimensions in Inches.

FIG. A1 Vapor Pressure Bomb.